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# Evaluation of Transportation Control Measures
# for
# Federal and State Ozone Plans

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**Introduction**
This report is intended to provide helpful information on gauging emission reduction benefits from various types of Transportation Control Measures (TCMs) that can be considered for federal and state ozone plans. One of the main purposes of the report is to provide a more comprehensive understanding of emission reductions and costs for those measures that have received recent attention as part of the current ozone planning process. The report builds on earlier analyses of Further Study Measures in the 2001 Ozone Attainment Plan and on additional screening of Reasonably Available Control Measures. The analysis is based on the best available assumptions. Where possible, an effort is made to use real world examples or rely on relevant information that has been previously developed. By quantifying the emission reduction benefits of certain categories of measures, it will be easier to assess the potential benefits of other measures that might fit under these categories.

Information for each measure is grouped according to the following topics:

- Description/Market Served
- Background
- Methodology and Key Assumptions for Calculations
- Emission Reductions
- Cost Effectiveness
- Other Benefits/Impacts

Most of the topics above are fairly self explanatory. Displaying the emission assumptions provides better insight into how the reductions were derived. The cost effectiveness information includes capital and operating costs, where available, which can be compared to the amount of emissions reduced-- recognizing that for many transportation measures the air quality benefits may be secondary to improved mobility. The discussion of other benefits/impacts conveys information on non air quality related factors which may be important in considering whether to further consider certain measures.

The selection of new measures for federal and state plans will ultimately depend on the Bay Area's attainment status and projected level of further emission reductions needed to achieve the ozone standards. The process for making these determinations is still underway

**Bay Area Travel and Mobile Source Emission Projections**

- Motor vehicle emissions are calculated by knowing the number of vehicle trips, amount of vehicle travel that takes place (VMT), and the speed of travel. Transportation control measures may affect one or more of these factors to reduce motor vehicle emissions. The analysis year for most of the calculations is 2006, meaning that the emission characteristics of the vehicle fleet are those for 2006. Mobile source emission factors are from the California Air Resources Board (EMFAC2002 V2.2 Apr 23, 2003). Some of the key statistics are shown in the attached Figures at the end of the report.
- Figure 1 shows the daily regional vehicle trips, 2000 to 2020
- Figure 2 shows daily weekday vehicle miles of travel in the region, 2000 to 2020
- Figure 3 shows average emission rates for the Bay Area vehicle fleet, 2000 to 2020
- Figure 4 shows how emission rates change with average speed

- Figure 5 shows the calculated mobile source emission inventory for VOC, one of the chief precursors of ozone, 2000 to 2020
- Figure 6 shows the same for NOx, one of the chief precursors of ozone, 2000 to 2020
- Figure 7 shows the composition of mobile source VOC emissions by various categories of emissions: Start and Soak, and Running, 2006
- Figure 8 shows the same for NOx, 2006

In addition, a number of additional TCM suggestions were received which cannot accurately undergo quantitative analysis. Qualitative responses are provided in the Appendix to this report.

## Measure: Enhanced Bus

Description/Travel Markets Affected

Enhanced bus is a type of service that employs modest schedule optimization techniques together with increased bus frequencies to provide a higher quality of service. Typical improvements include relocated bus stops, signal priority for buses when buses are behind schedule, improved shelters and signage, and real time schedule information. New riders would be attracted to transit through more frequent and reliable service and would include both work and non work trips.

Background

Several Bay Area transit operators have funded or proposed Enhanced Bus routes: AC Transit, Muni, and VTA. For some routes associated costs and ridership estimates have been developed.

Methodology and Key Assumptions for Calculations

The analysis is based on four routes proposed by AC Transit and uses the cost and ridership information on these route: Foothill/MacArthur, Shattuck/Alameda; MacArthur/Airport; College/University. New riders estimated by AC Transit were used as the basis for the calculations. A portion of these riders would not have access to a car, and therefore their trip would not replace a car trip (50% was assumed based on CARB estimates). The length of the bus trip was assumed to be a little over three miles. Access to the bus route would be primarily by walk/bike, but there would be some minor amount of auto access as well. There will be some additional emissions created by the new buses used in the service.

| Route | Annual Estimated New Riders | Estimated New Daily Riders | New Daily Riders Minus Transit Dependant Riders |
|---|---|---|---|
| Foothill/MacArthur | 1,672,800 | 5,179 | 2,589 |
| Shattuck/Alameda | 1,116,000 | 3,455 | 1,728 |
| MacArthur/Airport | 2,960,100 | 9,164 | 4,582 |
| College/University | 3,501,000 | 10,839 | 5,420 |
| Totals | 9,249,900 | 28,637 | 14,319 |

| | Transit Access Mode Percentages | Trips | VMT Displaced |
|---|---|---|---|
| Vehicle Driver | 14.8% | 2,119 | 6,252 |
| Vehicle Passenger | 5.1% | 730 | 2,154 |
| Bicycle | 0.5% | 72 | 211 |
| Walk (Linked) | 50.9% | 7,288 | 26,603 |

| | | | |
|---|---|---|---|
| Other | 0.2% | 29 | 105 |
| Walk (Unlinked) | 28.5% | 4,081 | 14,895 |
| Totals | | 14,319 | 50,220 |

- Average transit trip length equal to 3.3 miles
- Off-set transit access mode emissions included
-

Emission Reductions.

- **0.0769** tons per day of VOC
- ***increase*** of **0.0085** tons per day NOx

Cost Effectiveness

Capital cost for four routes: $132,750.000

Annual net operating cost for four routes: $7,319,000

Other Benefits/Impacts

The buses would have NOx and PM reduction devices. Several of the enhanced bus routes would serve minority and local income neighborhoods and are on MTC's Lifeline Transit Network.

**Measure: Bus Rapid Transit**

Description/Travel Markets Affected

Bus Rapid Transit is a further improvement in the Enhanced Bus concept, generally involving a higher level of capital investment to separate bus operations from normal traffic. Bus rapid transit may include dedicated lanes, more substantial stops and shelters, real time arrival information, and signal priority. The buses may be frequent enough that schedules are not required. The scale of the investments is such that they would normally be made in corridor with high levels of existing transit riders. To the public, the service would seem quite similar to that have a light rail vehicle. Like Enhanced Bus, new riders would be attracted through more frequent and reliable service and include both work and non work trips.

Background

Several Bay Area transit operators have proposed Bus Rapid Transit, either as an evolution of an Enhanced Bus route or as an initial project: AC Transit, Muni, and VTA. For some routes associated costs and ridership estimates have been developed

Key Assumptions for Calculations

The analysis is based on four routes proposed by AC Transit and uses the cost and ridership information for these routes: Foothill/MacArthur, Shattuck/Alameda; MacArthur/Airport; Telegraph/East 14th/International. New riders estimated by AC Transit were used as the basis for the calculations. A portion of these riders would not have access to a car, and therefore their trip would not replace a car trip (50% was assumed). The length of the bus trip was assumed to be a little over three miles. Access to the bus route would be primarily by walk/bike, but there would be some minor amount of auto access as well. There will be some additional emissions from the buses themselves.

| Route | Annual Estimated New Riders | Estimated New Daily Riders | New Daily Riders Minus Transit Dependant Riders |
|---|---|---|---|
| Foothill/MacArthur | 1,080,000 | 3,344 | 1,672 |
| Shattuck/Alameda | 787,200 | 2,437 | 1,219 |
| MacArthur/Airport | 525,000 | 1,625 | 813 |
| College/University | 518,400 | 1,605 | 802 |
| Totals | 2,910,600 | 9,011 | 4,506 |

| | Transit Access Mode Percentages | Trips | VMT Displaced |
|---|---|---|---|
| Vehicle Driver | 14.8% | 667 | 1,967 |
| Vehicle Passenger | 5.1% | 230 | 678 |
| Bicycle | 0.5% | 23 | 82 |

| | | | |
|---|---|---|---|
| Walk (Linked) | 50.9% | 2,294 | 8,371 |
| Other | 0.2% | 9 | 33 |
| Walk (Unlinked) | 28.5% | 1,284 | 4,687 |
| | | | |
| Totals | | 4,506 | 15,819 |

- 
- Average transit trip length equal to 3.3 miles
- Off-set transit access mode emissions included
- 

Emission Reductions.

- **0.0242** tons per day of VOC
- ***increase*** of **0.0027** tons per day NOx

Cost Effectiveness
Capital cost of four routes: $828,950,000
Annual net operating cost of four routes: $13,267,000

Other Benefits/Impacts
The buses would have NOx and PM reduction devices. Several of the Bus Rapid Transit routes would serve minority and local income neighborhoods and are on MTC's Lifeline Transit Network.

# Measure: Downtown Shuttles

Description/Travel Markets Affected

Downtown shuttles may either provide connections between the downtown and a nearby transit station or provide circulation between downtown businesses in lieu of taking a car or walking. New transit riders would be attracted due to the convenience of the service and possibly reduced parking fees. There may be some work trips, but the majority of the trips would likely be shopping or trips from a work location to a nearby business, restaurant, or shopping (say by workers during the lunch hour).

Background

Several cities have operated downtown shuttles, including Oakland, Walnut Creek, and Emeryville. Average daily ridership was: 820 (Walnut Creek), 1,600 (Broadway), and 2,500 (Emeryville). Shuttles are difficult to finance on a self sustaining basis and some services have been discontinued due to lack of funding.

Methodology and Key Assumptions for Calculations

The key to the analysis is how many auto trips would be eliminated due to the existence of the downtown service. It is likely that in some cases the trip on the shuttle would have been made on an existing transit service or by walking, or not at all, if the trip was too inconvenient. For this reason, we assumed that 45% of the trips were former walk trips, 45% of the trips replaced a car, and 10% of the trips were attracted to transit and replaced a longer commute trip. Most of the trips would be relatively short (one and a half miles) in length. In addition, there will be some additional emissions created by the shuttles used in the service (the majority of the shuttles operating in the Bay Area use diesel vehicles).

Emission Reductions.

- **0.0058** tons per day VOC
- **0.0050** tons per day NOx

Cost Effectiveness

The contract cost of operating a downtown shuttle would be $600,000 to $900,000 a year, assuming operating costs in the range of $50-$75 per hour of service. These estimates are based on a “typical” operation: 1 route, 4 vehicles, 12 hours a day, 5 days a week.

Other Benefits/Impacts

The shuttles would provide economic benefits to retail businesses by making them more accessible to nearby workers or residents.

## Measure: Shuttles to Transit

Description/Travel Markets Affected

Existing Bay Area shuttles provide important links between transit hubs and nearby businesses. There are more than 170 shuttles throughout the Bay Area. Shuttles to transit are designed to complement existing fixed route services, generally by filling in special or temporal gaps in service, or by providing more direct, limited stop service. Many of the trips are work oriented, as shuttles provide that “last mile” type of connection to complete trips. Other major shuttle markets include universities (Cal and Stanford) and medical centers.

Background

The vast number of existing shuttles connect to BART, Caltrain (52 routes), and ACE (where shuttles carry about 42 % of the riders to their final destination). Shuttles generally operate during the peak period. A particular shuttle service may have multiple routes. Caltrain shuttles carry about 6,000 riders a day.

Methodology and Key Assumptions for Calculations

The analysis is based on the Caltrain shuttle system. Shuttle trips from transit would be relatively short, less than five miles. The shuttle service would generally attract employees who would normally have used an auto to get to work. The average length of the commute trip was assumed to be 10 miles, reflecting the longer trips occurring on rail systems. It is assumed that new shuttles would be low emission vehicles.

- Assume shuttle riders are commuters who would have used a car instead of transit
- 10 mile work trip length between home and workplace
- Passenger vehicle mix: 90% LDVs and 10% SUVs
- 
- Assume 12 new employer shuttle routes with 800 riders per route for a total of 9,600 new daily riders

Emission Reductions.

- **0.10** tons per day of VOC
- **0.12** tons per day NOx

Cost Effectiveness

Assuming fully contracted service, 12 employer routes would cost about $1.1 to $1.6 million per year. This is based on each route having 1 vehicle, operating 7 hours a day for five days a week.

Other Benefits/Impacts

The shuttles would provide local circulation benefits by removing some peak hour traffic from local streets.

## Measure: New School Bus Service

Description/Travel Markets Affected

Many school districts have had to eliminate district-supplied school bus service in the face of growing budget pressures. School children in grades K-12 must then find alternative means to get to school, either using the public bus, getting dropped off and picked up by parents, driving or carpooling with fellow students, or biking/walking (if students live close enough to school). Some auto trips would be eliminated by re- instituting a school operated system that picked up students close to their home and dropped them off at school.

Background

MTC evaluated the potential costs of setting up school bus programs for those districts in Alameda County and described the results in a separate memo. Seven districts continue to provide service, and ten districts do not. A particular focus for this analysis was the Livermore Valley Joint Unified School District, which was used as a test case for the purpose of calculating costs and emission reductions.

Methodology and Key Assumptions for Calculations

Most districts with school buses do not serve children who live within one mile of a school. This factor reduces the eligible participants. For the Livermore District (K-8), it was assumed that 10% of the student population would take the school bus, based on a comparison with districts that currently provide home to school service and have similar demographic characteristics. Each student would generate two auto roundtrips a day, assuming the parents brought them to school and then picked them up. Trip lengths would be relatively short (average 2 miles in length).

| Vehicle Type | Total VMT Replaced | Total Round Trips Replaced (per school day) |
|---|---|---|
| Clean Bus | 3,956 | 1,978 |
| Conventional Bus | 3,956 | 1,978 |

Emission Reductions.

| Dropoff and pick up vehicle emissions | | Bus offset emissions | | Net Emission Reductions | | Bus Type |
|---|---|---|---|---|---|---|
| ROG | NOx | ROG | NOx | ROG | NOx | |
| 0.00477 | 0.00334 | 0.00001 | 0.00016 | 0.00476 | 0.00318 | Clean Bus |
| 0.00477 | 0.00334 | 0.00005 | 0.00077 | 0.00472 | 0.00256 | Conventional Bus |

**** Emissions in Tons Per Day**

Cost Effectiveness

Assuming school district contracts out service to a third party, it would cost between $45,000 to $54,000 per bus. It is estimated that a Livermore school district service would require 12 buses; therefore, the costs would range between $540,000 and $648,000 per year. In some existing services, parents contribute to the operation to help defer costs to the school districts.

Other Benefits/Impacts

The school buses would relieve local traffic at and around the school and would provide a safe means of transportation for school children.

## Measure: New Ferry Service

Description/Travel Markets Affected

New ferry service would reduce the number of transbay auto trips between the East Bay and San Francisco and between parts of the Peninsula and San Francisco. The service would be targeted to selected markets where the potential would exist to attract new riders to transit. New vessels would be fast and frequent with convenient feeder bus connections. The primary market would be work trips, although certain routes would be expected to have a robust non-work/recreational component.

Background

Expansion of ferry service on the Bay has been studied by the Water Transit Authority, a new transit agency created by the Legislature to plan and operate new routes. The WTA has developed and adopted an Implementation and Operations Plan which identifies new route opportunities and their costs. The Plan recommends six initial routes for operation: Pittsburgh/Antioch/Martinez to SF; Hercules/Rodeo to SF; Richmond to SF; Berkeley to SF to Mission Bay; South San Francisco to SF, and Redwood City to SF. Some of these routes could be funded through new state legislation requiring voter approval of a $1 increase in bridge tolls.

Methodology and Key Assumptions for Calculations

The analysis is based on the WTA's ridership projections. While the projections are for somewhat distant years, it is assumed that these levels will materialize in 2006. After adjusting the forecasts for riders who switch from another transit mode, the rest of the ferry riders are assumed to be diverted from single occupant autos. The WTA has also estimated the various access modes used to get to and from the terminals, and these splits were used in the emission calculations. The ferries themselves will produce some level of emissions, although the WTA plans to acquire vessels that are even cleaner than EPA's standards. Calculations were made to account for the offset emissions which would be generated by feeder bus service to the terminals..

| | | Walk | Drive | Transit | Total Trips |
|---|---|---|---|---|---|
| 1 | [CC] Pittsburg/Antioch - Martinez - San Francisco | 18 | 1,496 | 14 | |
| 2 | [CC] Hercules/Rodeo - San Francisco | 129 | 464 | 107 | |
| 3 | [CC] Richmond - San Francisco | 164 | 1,076 | 95 | |
| 4 | [Ala] Berkeley - San Francisco - Mission Bay | 18 | 1,342 | 408 | |
| 5 | [SM] Oyster Point (South SF) - San Francisco | 96 | 1,619 | 157 | |
| 6 | [SM] Redwood City - San Francisco | 57 | 965 | 44 | |
| | | 482 | 6,962 | 824 | 8,268 |

- Average trip length is 20 miles
- Assume 25% of ferry riders are from another transit system, and the rest used a car

Emission Reductions.

- **0.1498** tons per day VOC
- **0.1752** tons per day NOx

Cost Effectiveness

The WTA estimates were used for capital and net annual operating costs.

- Capital cost for six routes, including vessels and terminals: $175,000,000
- Net annual operating cost for six routes: $90,000,000

Other Benefits/Impacts

Ferries would serve a vital transportation role in the event of an earthquake that damaged one or more Bay bridges. New terminals provide an opportunity for transit oriented development around the terminals.

## Measure: New Rail Extensions

Description/Travel Markets Affected

This analysis focuses on possible new rail services in three corridors: Marin-Sonoma (SMART), Route 4 (eBART), and I-580 in the Tri-Valley (tBART). These services would provide an alternative to auto travel in highly congested corridors. Reduction of longer distance auto trips in these corridors would have emission benefits and could improve overall freeway operations as well (highway traffic that moves more freely would generate lower emissions). It is anticipated that initial service would focus on the commute period and work trips, and off peak service for non work trips would be more limited.

Background

All three rail corridors are in various stages of detailed study and analysis. Full funding has not yet been identified for these rail expansions, although a combination of new bridge tolls and county sales tax measures, if passed by the voters, could provide significant new funding. The services envision lower cost diesel multiple unit (DMU) technology on standard railroad tracks. Stations would be located at key ridership hubs, and service frequency would depend on the amount of operating funds

Methodology and Key Assumptions for Calculations

Ridership estimates are based on the most recent study results and future year forecasts are assumed to occur in 2006: tBART (2,240 daily *new* trips on transit); eBART (7,000 daily new trips), and SMART (5,090 daily transit trips). Because eBART and SMART are total transit riders, rather than new riders, a small portion of the riders are assumed to be shifted from existing transit services in the corridor (15%). Trip lengths on SMART would be similar to Caltrain, whereas those on eBART and tBART were assumed similar to BART. Emissions for the rail vehicle are assumed to be based on the most advanced engine technology. While rail service could result in improved highway operations in highly congested corridors, no emission reductions have been calculated for these reductions.

- Assume work trips on transit are shifted from autos
- Average trip length for tBART and eBART is 12.9 miles and average trip length for SMART is 17.3 miles

Emission Reductions.

- **0.1005** tons per day VOC
- ***increase*** of **0.0700** tons per day NOx

Cost Effectiveness

Costs are from the 2001 Regional Transportation Plan and Resolution 3434.

- Capital costs for three new rail services: $890,000,000
- Net annual operating costs: $14,000,000

Other Benefits/Impacts

New rail systems could lead to increased economic development around rail stations and stimulate the local economy during construction. New stations provide opportunities for transit oriented development. Some of the mobility benefits would extend considerably beyond the date of initial operation as the corridors in which these systems operate become even more developed and congested.

**Measure: Real Time Transit Information**

Description/Travel Markets Affected

Transit agencies of various sizes are beginning to invest in real time bus and train arrival information for their customers. This capability is made possible by GPS systems which can identify the precise location of a transit vehicle and which can be compared to scheduled arrival information at the next stop. The arrival information is conveyed to the customer through various types of electronic signs. Increased transit ridership would be an indirect benefit of these systems, and would result from improved customer perceptions about the transit system's convenience and a feeling that transit service has improved. People traveling at night feel more secure when they have accurate bus arrival information. The market would be both commute trips as well as non-work trips.

Background

MTC has surveyed Bay Area transit operators to determine the status of  programs for AVL technology. Real time transit information is provided by BART and Muni light rail, and on AC Transit's San Pablo enhanced bus corridor (50 display units). Other operators in the Bay Area are in various stages of exploration of AVL technology. Over time it is expected that the systems will be deployed in greater numbers affecting a larger percentage of regional transit users.

A literature search shows only limited data correlating transit ridership to the presence of real time arrival information, and what data does exist may not be directly transferable from one area to another. According to TCRP report Synthesis 48, customer reactions to real time bus arrival information has been positive among the transit operators surveyed. However, none has reported a definitive increase in ridership as a result of deploying such a system. Where ridership did increase, it was difficult to determine whether it was a direct result of the real time information system.

Methodology and Key Assumptions for Calculations

Impacts on transit ridership could range from nil (0%) to 5% (based on limited European data which may not be transferable to the US). Assuming real time information would be applied first to the most heavily used transit routes, emission calculations were made by assuming ridership increases of between 1% and 5%. Average weekday boardings on the seven most heavily used bus routes in the Bay Area (all Muni routes) ranged between 25,000 and 52,000 daily riders. The assumed ridership increases discussed above were then discounted by the number of transit dependent riders, those riders without cars. Assumptions were also necessary as to mode of access to the bus routes. Bus emissions were also factored in, since these routes are already crowded and the increased ridership could result in the need to add buses.

Emission Reductions.

- A range of **0.0067** to **0.0036** tons per day VOC
- A range of  **0.0033** to **0.0166** ***increase*** in tons per day NOx

Cost Effectiveness

AVL based real time information systems can have widely ranging costs, depending on the size of the system deployed. Several Bay Area experiences are reported below:

- -Muni Light Rail and Filmore 22 line: about $9.5 million to day and $1.3 million for operations and maintenance; capital cost for subsequent phases estimated at $3.5 milllion for trolley coach line and $4.5 million for motor coaches
- -AC Transit: AVL system was part of an overall radio communications upgrade. San Pablo corridor (50 display units) capital cost was $70,000 with an annual operating cost is $75,000 per year
- -Initial start up operations for VTA and LAVTA estimated at about $3million.

Other Benefits/Impacts

As discussed above, there is improved customer satisfaction with transit and improved visibility of transit in the community. Also public bus operators have improved control of their system with accurate real time information on the location of all their vehicles.

## Measure: Transit Priority at Signals

Description/Travel Markets Affected

This type of strategy would grant transit buses priority at signalized intersections if the bus is running behind schedule. In a centralized system the dispatcher would activate the priority system. In a decentralized environment, the bus operator would activate the priority treatment. In both cases, closer adherence to schedules would generate a positive trip experience by providing more predictable travel times. Like the real time travel information, the user would generally perceive the strategy as an improvement in transit service. Both work trips and non-work trips would be affected. Because of the similarity in terms of overall impact to the real time transit measure discussed previously, the same emission reduction methodology and estimates have been used.

Background

AC Transit has analyzed the technical requirements for transit priority streets in enhanced bus corridors and is implementing the system on the newly operating San Pablo corridor.

Methodology and Key Assumptions for Calculations

The methodology is the same as for real time transit information systems above including the effect of increased bus emissions from increased ridership resulting in the need to add buses.

Emission Reductions.

- A range of **0.0067** to **0.0036** tons per day VOC
- A range of **0.0033** to **0.0166** ***increase*** in tons per day NOx

Cost Effectiveness

Studies of the cost of providing signal priority treatment on various AC Transit routes shows costs between $125,000 and $1, 300,000 depending on the route, number of signals and existing software and interconnect capability.

Other Benefits/Impacts

As discussed above, there is improved customer satisfaction with transit.

## Measure: Regional Vanpool Program

Description/Travel Markets Affected

Ridesharing services operated in the Bay Area have resulted in about 864 formal vanpools operating today, carrying about 9,000 riders. Emission reduction estimates have been made for this large scale vanpool program. Vanpools generally serve longer commute trips. Riders typically assemble at a pre-determined location. Vanpools use carpool lanes where they are available to save travel time. Operating costs are largely covered by the riders. Each vanpool eliminates auto trips, and the exact reduction depends on the former mode of vanpoolers, i.e., whether they came from a single occupant vehicle, transit service, or carpool. Vanpools largely serve the work trip market.

Background

Rides for Bay Area Commuters has been assisting commuters in forming vanpoolers for over 20 years. Recent efforts have focused on increasing the effectiveness of their placement services. A continuing part of their work is the refilling of vanpools when members drop out; therefore, retaining the existing number of vanpools in operation involves a significant amount of effort as well.

Methodology and Key Assumptions for Calculations

Data for the vanpool calculations was obtained from RIDEs. In addition to trip length, the other important factors are former mode of travel and how vanpool riders get to and from their collection point. Driving to the collection point generates auto trip start emissions and travel emissions for the trip to the vanpool. The vanpools themselves create emissions which must be factored into the calculation. The basic assumptions are:

- 864 Vanpool vehicles in the Bay Area
- Average Vanpool size equals 10.5 persons
- Average trip length equals 49.2 miles

From the RIDEs' 1999 Vanpool Survey, trips and VMT were allocated according to mode to Vanpool Pick-Up location.

| Vanpool Access Mode | | Trips | Displaced VMT |
|---|---|---|---|
| Picked up or walk | 17.2% | 1,562 | 76,833 |
| Carpool | 6.6% | 596 | 29,312 |
| Bicycle | 0.9% | 81 | 3,997 |
| Drive Alone | 74.2% | 6,734 | 331,315 |
| Transit | 1.1% | 99 | 4,885 |
| | | 9,072 | 446,342 |

Emission Reductions.

- **0.3353** tons per day VOC
- **0.3519** tons per day NOx

Cost Effectiveness

- Administration of the existing regional vanpool program is through RIDEs. Generally the riders in the van pay a monthly fee which helps defray the lease costs, which may or may not include insurance and gas. The average cost per month is about $150 per rider, with costs increasing for longer commutes.

Other Benefits/Impacts

Energy savings are an important aspect of vanpools as they reduce the number of long distance vehicle trips. Also, in certain corridors, vanpools using carpool lanes can be a significant factor in reducing peak hour vehicle trips.

## Measure: HOV Lanes and High Occupancy Toll Lanes

Description/Travel Markets Affected

HOV lanes provide travel time savings and trip reliability improvements that act as an inducement to carpooling. A form of HOV lanes, called High Occupancy Toll lanes, would allow single occupant drivers to “buy into” the HOV lanes when they are underutilized and access the travel benefits above. The feasibility of the HOT lanes depends on the location and current carpool utilization. Since most HOV lanes are operated as such during the commute hours, the primary market would be work trips.

Background

The region currently has about 298 lane miles of HOV lanes (including freeways and expressways). In its most recent HOV Master Plan update, MTC analyzed new HOV lane concepts and the relative emission reductions for: an expanded HOV system; expanded HOV system with express bus; HOV lanes converted to 3+ occupancy requirements; express bus with conversion of select mixed flow lanes to HOV(also 3+ occupancy for carpools). The report did not, however, look at High Occupancy Toll lanes from an air quality perspective.

Methodology and Key Assumptions for Calculations

High Occupancy Toll lanes operate on the principal that there is capacity to “sell” to single occupant vehicles that desire to save travel time. Thus the critical factor is where the HOV system has excess capacity. MTC’s travel demand model forecasts were used to determine where this excess capacity exists. Allowing single occupant vehicles into the HOT lanes will reduce traffic in the adjacent mixed flow lanes, which will then result in slightly improved speeds and the attendant emission reductions. The optimum use of HOT lanes would be about 1,600 vehicles per hour to maintain a travel time advantage over the mixed flow lanes. Key potential HOT corridors were identified as portions of :

- I-680 (Alameda and Contra Costa Counties)
- US 101 (Marin and Sonoma Counties)
- Portions of US 101 (San Mateo and Santa Clara Counties)
- Route 4 (Contra Costa County East)
- Route 85 (Santa Clara County)

Emission Reductions.

- **0.0659** tons per day VOC
- ***increase*** of **0.0959** tons per day NOx

Cost Effectiveness

Converting an existing HOV lane to HOT, would be the least expensive way to implement HOT. The study conducted of the US 101 Corridor in Sonoma County showed an incremental cost of about $120,000 per mile for non-HOV lane construction items (signs, toll readers, pylon barriers, etc). On the high cost end would be the construction of new HOT facilities, such as new lanes and direct HOT-to-HOT connectors at major interchanges. In a recent study, The Reason Foundation has estimated the cost of a 630 mile integrated HOT network in the Bay Area to be about $4.5 billion.

Other Benefits/Impacts

HOT lanes would improve the operational efficiency of the freeways by making use of unused HOV lane capacity and providing travel time savings to those willing to pay, which in turn, provide benefits to vehicles in the adjacent lanes as well. Any revenues that remain after servicing construction debt could be used for new transit or carpooling options in the corridor with the HOT lane.

**Measure: $3 Bridge Toll**

Description/Travel Markets Affected

Raising the toll on all state-owned bridges would reduce auto driving to some limited extent, as some trips would be shifted from toll paying to less costly transportation options, such as BART, bus or carpooling depending on the bridge. The level of mode shift would depend on the amount of the increase. This analysis is based on tolls increasing from $2 to $3. Both work and non work trips would be affected by the toll increase.

Background

SB 916 (Perata), signed by the Governor, will allow Bay Area voters do determine in March 2004 whether tolls should be increased to pay for a specific set of projects in an associated expenditure plan. The tolls will also pay for the operating costs of some of the new transit services, such as ferries.

Methodology and Key Assumptions for Calculations

The analysis only addresses the impact on travel behavior of the toll increase itself, and does not address the complimentary effects of investing these revenues in new transportation improvements and options. Research using MTC's travel demand model indicates that toll vehicle elasticities vary by bridge and are higher in the peak period than the off peak period. While higher tolls do impact driving costs, overall n Transbay auto use is fairly inelastic with respect to toll increases. MTC's research shows an elasticity for regional vehicle trips of about -.029, meaning that for every 100% increase in tolls, regional vehicle trips would decline 2.9% (vehicle trips across the Bay would decline by a higher percent, but Transbay travel in aggregate is only about 4% of all daily regional trips). A $3 toll would represent a 50% increase in the current toll of $2. .For the purpose of the analysis it was assumed that the typical Transbay auto trip is 20 miles. Calculations were made to account for the offset emissions which would be generated from additional trips on motor bus as former auto users are shifted to transit.

Emission Reductions.

- **0.0522** tons per day VOC
- **0.1051** tons per day NOx

Cost Effectiveness

Not applicable

Other Benefits/Impacts

As mentioned above, higher bridge tolls will help fund other road and transit improvements that directly benefit the bridge corridors. The expenditure plan for Regional Measure 2 on the March 2004 ballot lists these improvements.

## Measure: Regional Gas Tax

Description/Travel Markets Affected

Increasing the tax on gasoline would affect all vehicle trips made throughout the region, and even small changes in travel behavior and auto use could have significant cumulative effects. Changes in gasoline prices at the pump would affect all trip purposes..

Background

MTC has been granted authority by the State Legislature to seek voter approval of a gas tax of up to $0.10 per gallon for 20 years. At current prices for regular gasoline ($1.65 per gallon), a 10 cent increase would be about a 6% increase in price. A regional gas tax would fund a set of eligible projects and programs developed through an expenditure plan process. Periodic polling conducted by MTC shows that it would be difficult to obtain the current 2/3 approval to put an increase into effect.

Methodology and Key Assumptions for Calculations

The methodology is similar to that for the bridge toll increase, and relies on price elasticities derived from MTCs' travel demand forecast model. The calculated elasticity from MTC's travel demand model is –0.036, indicating that a 10% increase in costs would generate a 0.36 percent decrease in regional vehicle trips. As gas prices increase in the future the impact of a constant 10 cent tax on driving will diminish, since the regional gas tax is not adjusted for inflation. Calculations were made to account for the offset emissions which would be generated from some auto users shifting to buses.

Emission Reductions.

- **0.7018** tons per day of VOC
- **0.4040** tons per day NOx

Cost Effectiveness

Not applicable

- Cost effectiveness

Other Benefits/Impacts

As mentioned above, regional gas tax revenues would be used to will help fund a set of transportation improvements that have not yet been defined, but which would have to meet certain eligibility criteria in the enabling legislation. The improvements generally would allow revenues to be used for most types of transportation projects with the exception of new mixed flow road capacity.

## Measure: Parking Charges at Work Sites

Description/Travel Markets Affected

Currently most private employer parking is free and treated as an employee benefit. A small number of spaces (those that are leased by a company) are subject to parking "cash out" provisions in state law. If employees were required to pay for their parking, there would be changes in travel behavior as has been documented in several locations where charges were levied. Depending on the options available at the specific work location, charges could result in increased use of transit (if convenient and available), formation of additional carpools (to reduce the cost to the individual), or increased use of non motorized travel by employees living close to work (bike/walk). There are many variations on how parking charges could be applied, such as a basic hourly charge, reduced charges for carpools, air pollution charge reflecting emission characteristics of the vehicle, etc. The primary market would be work trips.

Background

Parking charges have been repeatedly evaluated in a theoretical manner. Of the 3.7 million jobs in the Bay Area, MTC estimates that about 82% of these jobs are located in MTC travel analysis zones with no parking costs. MTC's last evaluation of parking charges impacts at the regional level occurred during the development of the 2000 *Transportation Blueprint for the 21st Century*, which included several types of "sensitivity" analyses. The results below are based on this study.

Methodology and Key Assumptions for Calculations

Using the *Blueprint* analysis, the relative impact of additional parking charges can be determined. In this analysis a daily rate of $2.60 was added to all parking spaces that were work related. A space that is not currently charged would have a daily fee of $2.60, whereas a space that does have a charge would have $2.60 added to the price. This pricing assumption then affects auto operating costs in the regional travel demand model, resulting in mode shift changes. Overall, it was found that regional vehicle trips decreased 0.7% with similar changes in vehicle miles of travel. Calculations were made to account for the offset emissions which would be generated from auto users shifting to buses.

Emission Reductions.

- **0.8187** tons per day VOC
- **0.4713** tons per day NOx

Cost Effectiveness

Not applicable

Other Benefits/Impacts

Parking charges would presumably be used to fund commute alternatives for the employees paying for the parking, either in the form of commute allowances, shuttles to transit, vanpool subsidization, or contributions to the local transit operator for more convenient service.

## Measure: Bike Storage at Rail Stations

Description/Travel Markets Affected

Having adequate bike storage in the form of lockers or racks is an essential element in increasing bike access to transit stations. The demand for secure storage is increasing, because of the cost of some of the newer bicycles. Most rail stations have some amount of storage and could expand this to some degree. Storage tends to be used by commuters who leave their bikes at the station all day. The markets are both work and non work trips.

Background

This measure evaluates the air quality benefits of the current BART bike storage system, including lockers and racks. About 2% of the access trips to BART stations are by bike. There are currently about 2,716 spaces for bicycles in racks and 819 locker spaces.

Methodology and Key Assumptions for Calculations

The emissions analysis assumes all spaces are used on a daily basis, and that the bike trips replace a car access trip. These assumptions would generate the maximum emission reductions.

Assumptions-Bikes stations, etc.

- BART is adding 1,200 new bike storage units
- 5 mile trip length between home and transit station
- Vehicle fleet mix: 90% LDVs and 10% SUVs

Emission Reductions.

- **0.0450** tons per day VOC
- **0.0487** tons per day NOx

Cost Effectiveness

The cost of a bike locker is about $1,500 and the cost of a rack is about $100 per space.

Other Benefits/Impacts

Shifting station access trips can relieve pressure for providing expensive new auto parking. Bike use can also lessen traffic around stations.

## Measure: Safe Routes to Transit

Description/Travel Markets Affected

This measure would focus on the routes used to access transit stations by biking or walking. The intent of the measure would be to increase pedestrian and bicycle access to through safer and more convenient access. Emphasis would be on routes serving regional transit centers. Concerns with current routes range from personal safety to physical obstacles that make bike and walk access to stations difficult or impossible, to adequate signage. Both work and non work trips are potential markets.

Background

Safe Routes to Transit has been promoted by several Bay Area advocacy organizations. The concept is modeled after very successful programs in Japan, Germany, and the Netherlands to increase the use of bicycles to transit. Recent legislation (AB 916) would raise bridge tolls, if authorized by Bay Area voters in March 2004, and dedicate some of the money for a Safe Routes to Transit program. This measure evaluates the air quality benefits of increasing bike/walk access to BART. About 25% of the access trips to BART stations are currently made by biking and walking.

Methodology and Key Assumptions for Calculations

The assumptions are similar to those for the bicycle storage measure. Overall it is assumed that pedestrian and bike access to BART would increase 20% above current levels due to access improvements. It was further assumed that these new users would have previously driven a car to the station (although they may have used transit as well). (We did not take into account the creation of new transit trips overall because of the lack of empirical data that would connect the types of access improvements proposed ot larger travel behavior decisions.). The benefits below would increase to the extent the safe routes program generated new transit riders that formally made their entire trip by car.

- Increase in bike/walk access to BART from 25% to 30% affects 6,250 trips a day
- 3 mile trip length

Emission Reductions.

- **0.0358** tons per day VOC
- **0.0279** tons per day NOx

Cost Effectiveness

The cumulative cost of the priority Safe Routes for Transit projects was estimated by advocates to be $203 million, but individual projects range from several hundred thousand (for bile lane improvements or new bicycle garages) to over $3,000,000 when it comes to constructing new bike/ped overpasses.

Other Benefits/Impacts

Shifting station access trips can relieve the pressures on providing expensive new parking. Bike/walk access can also lessen traffic around stations.

## Measure: Station Cars at Transit Stations

Description/Travel Markets Affected

Station cars allow transit patrons another travel choice for getting to dispersed destinations around transit stations (work, shopping, schools, residential areas, etc.). The concept would be to develop pods of 3-4 cars that could be placed at or near transit stations and available to riders for their immediate access needs. The cars themselves would be low emission vehicles. Technological advancements make it possible to reserve cars "on the fly" and to track cars as they are being used. Air quality benefits would accrue to the extent that the availability of the station car program influences the choice between using transit or driving. The markets affected are both work and non work trips.

Background

MTC analyzed the station car concept as a Further Study Measure in the 2001 Ozone Attainment Plan. There have been several pilot programs for station cars, but no recent expansion. In 2003 Caltrans requested applications to fund deployment of station cars in different parts of the state. MTC worked with the transit operators to develop a proposal, but funding shortages prevented Caltrans from moving forward. It is assumed that the administration of a regional station car program would be by an existing carsharing provider, rather than the transit operator. The following calculations illustrate the emission impacts of such a program.

Methodology and Key Assumptions for Calculations

The analysis of emission benefits is based on a 1,000 station cars distributed to various BART, Caltrain, and light rail stations.

- Each car generates "new" transit trips, i.e., replaces trips that were formally made by car:
- For work trips, a scenario would be:
    1. A person uses their own car or transit to get to the rail station in the morning
    2. They pick up a car at the destination end of the trip and use it to get to work; they keep the car all day (possibly using it for errands in the mid-day) and return it to the station in the evening.

- For non work or work-related trips:
    1. A person uses their own car or transit to get to transit
    2. They pick up a car at the destination end of the trip and return it when done.

- Vehicle mix for station car fleet: 50% SULEV and 50% ZEV
- Vehicle mix for cars replaced: 90% LDVs and 10% SUVs
- 100% cold start modes for 800 Station cars
- 5 mile trip length for Station car travel from transit station to workplace

16 mile work or other trip length replaced by "new" transit trip

- Each of the 200 Station cars are used 5 times a day
- 1 out of the 10 daily Station car uses is assigned a cold start emission factor, the other 9 daily starts are assigned an average start emission factor

- Station cars are replacing one trip chaining event for each person’s work-to-home journey (i.e., to run an errand on the way home from work)
- One-way 5 mile trip for Station car non work travel from transit station to errand location
- Average 30 minutes vehicle rest time while errand is being conducted

Emission Reductions.

- **0.009** tons per day VOC
- **0.018** tons per day NOx

Cost Effectiveness

Based on work performed for Further Study Measure 5 in the 2001 Ozone Plan:

- Vehicle cost(1,000 cars): $15 to $26 million, depending on technology
- Parking infrastructure (charging of electric vehicles): possible additional $7 to $22 million
- Administration cost: $ 5 million per year

Other Benefits/Impacts

Indirect benefits include raising the visibility of the carsharing concept among the larger Bay Area population. Increased participation in an areawide carsharing program could postpone the need to add cars to a household and possibly reduce the number of overall trips as people become more aware of the auto ownership costs that can be avoided through carsharing (see next measure).

## Measure: Carsharing

<u>Description/Travel Markets Affected</u>

Carsharing allows people to have access to a car without owning one by becoming a member of an organization that provides an opportunity for s people to reserve cars and pay for the amount of time they actually use them. This arrangement avoids much of the overhead costs of car ownership (depreciation, insurance, repairs, etc.). Major expansion of existing programs could allow people to own fewer cars and, over the long term, change travel behavior and driving habits. The markets are both work and non work trips, although surveys of current carshare participants show more use of cars for non work trip purposes (personal business and social recreational trips).

<u>Background</u>

The largest regional carsharing program is operated by, City CarShare with over 2,800 members currently. City CarShare members are predominately located in San Francisco and to a lesser extent Oakland and Berkeley. Many of City CarShare members (2/3) come from carless households, therefore they use carsharing to obtain greater convenience and save time over trips s formally made by biking, walking, or transit. For those members who own a car(s) and are thinking about owning additional cars, emission benefits may occur if overall household travel is less in the future than would occur through having additional owned vehicles available to the household (this aspect of future travel behavior is the most difficult to ascertain).

<u>Methodology and Key Assumptions for Calculations</u>

Calculating emissions under various carsharing scenarios is not straightforward, given the multiple types of situations involved. For people that do not own a car, carsharing creates additional vehicle trips and miles of travel. For those who do own cars, carsharing may substitute for ownership of additional cars with unclear overall trip reduction potential. Emission benefit calculations are further complicated by the emission characteristics of the carsharing vehicle relative to other modes that would have been used for a member's trips. Therefore, we have analyzed several scenarios using, to the extent possible, results from a recent City CarShare survey.

1) Base Case: Existing carshare vehicles (subcompacts) and use characteristics (emission characteristics of City CarShare vehicles relative to the average Bay Area fleet)
2) Super Low Emission vehicles: assumes carsharing vehicles are very clean
3) Zero Emission Vehicles: assumes no emissions for carsharing vehicles

Other key assumptions are listed below:

- Expanded Carsharing penetration equal to 0.5% of residents in San Francisco, Oakland, Berkeley (26,000 households)
- 67% of members from carless households, 20% from 1-car households, 10% from two car households, and 3% from household with more than 2 cars
- Carsharing used for 8% of trips in all households
- 67% of these trips add vehicle trips by carsharing vehicles; 33% substitute trips for other vehicles as described in "1" to "3" above

- For the 33%, assume the vehicle not used is 5 years old
- Average trip length of 6 miles

Emission Reductions.

- A range of **0.0439** to **0.0600** tons per day VOC
- A range of **0.0422** to **0.0569** tons per day NOx

Cost Effectiveness

Not calculated.

Other Benefits/Impacts

Carsharing may reduce parking requirements for new residential and commercial development, if available at or near the new development. As mentioned above, participation could lower personal ownership costs associated with second or third cars, and provide indirect salary increases.

## Measure: Signal Coordination

Description/Travel Markets Affected

Signals control the flow of traffic on major streets. They can either be coordinated along a route or operate independently. Coordination of signals along an extended route can reduce stop delays and increase overall average speed. This in turn has a positive impact on emissions. The trips affected include both work and non work trips.

The existing TCMs for signal coordination assumed a smaller number of signals in the region than are currently in existence. A more complete picture of Bay Area signal status was developed as part of an effort to construct an arterial database for the region. Thus, there is additional emission credit that could potentially be taken if the signals that are not currently coordinated were to become part of the larger coordinated signal system.

Background

MTC funds updating of signal timing plans to respond to changing traffic conditions as well as new signal software installation to allow coordination. Signal coordination efforts have long been recognized as a way to improve the flow of traffic on local arterials and conserve energy. A recent study of retiming 223 signals in San Jose associated with 28 separate signal systems showed the following results:

- 32.6% reduction in average stopped delay
- 30.8% reduction in stops
- 16.1 % reduction in travel time
- 14.5% reduction in VOC

Methodology and Key Assumptions for Calculations

There are about 7,500 signals in the region, of which all but 2,500 are coordinated. The original TCM analysis assumed there were 5,000 signals in the region. Of the 2,500 uncoordinated signals, perhaps half of these are close enough to another signal to make coordination beneficial. Therefore, the analysis assumes 1,250 newly coordinated signals.

- Travel using new signalized arterials equals 3,200,000 daily VMT
- Increase in average speed from 17.9 mph to 21.6 mph (actual survey results)
- ROG emission factor reduction equal to –0.088 grams per mile
- NOx emission factor reduction equal to –0.079 grams per mile

Emission Reductions.

- **0.310** tons per day VOC
- **0.279** tons per day NOx

Cost Effectiveness

- The cost of signal coordination is about $1,500 per signal, for a total cost of $1.9 million for coordinating 1,250 signals.

Other Benefits/Impacts

Retiming signals has been shown to be an effective fuel conservation strategy as there are fewer starts and stops and less idling at intersections.

## Measure: Roundabouts

Description/Travel Markets Affected

Roundabouts allow traffic to flow continuously through an intersection without requiring vehicles to stop. In a roundabout, traffic merges into the stream and then travels around the center circle to the desired exit, all without stopping. Overall intersection capacity is increased because there is no stopping of vehicles or wasted time during the amber signal phase. Emissions are lowered because there is no vehicle stopping, idling, or acceleration involved.

Background

While common in Europe, only a handful of US cities have installed roundabouts. Roundabouts arrived in the US around 1990, and in 2000 there were about 300 in existence. In the United Kingdom (UK) where roundabouts have been employed extensively, the number of roundabouts and traffic signals is about the same. UK roundabouts generally have 2 to four lanes and tend to be on higher volume streets compared to the US. Capacities of up to 8,000 vehicles per hour have been achieved in the UK. While roundabouts may work in some traffic conditions better than signals, retrofitting roundabouts into an already built out street environment would be a challenge in many instances.

Methodology and Key Assumptions for Calculations

Estimating the emission benefits from roundabouts is difficult without knowing the specific design, setting, and traffic conditions. Traffic planning tools require extensive information related to the specific application to evaluate the benefits Therefore, the method used was to perform a literature search to see what analyses had been performed relative to air quality.

Emission Reductions.

The following information was obtained from a literature review.

- The emissions for stopped vehicles are about 4-5 times greater than slowly moving vehicles
- Emission studies cited in the literature have indicated reductions in VOC and NOx in the range of 30% to 50% depending on how the base conditions are defined (i.e., an intersection with stops signs, an isolated intersection with signals, or a signal that is part of a larger coordinated signal system)
- Signals would create stop and go conditions during the off peak, when they may not need to; roundabouts would operate efficiently throughout the day.
-

Cost Effectiveness

- Unknown. Depends on particular application.

Other Benefits/Impacts

Roundabouts provide significant safety benefits. Roundabouts usually constrain speed at the point of entry using splitter islands. Safety is improved because speeds through the roundabout are low (reducing the chance for severe injury or fatality), and accidents where two cars collide at 90 degrees (the most serious type of accident) are eliminated. The Insurance Institute of Highway safety found that roundabouts reduced total crashes by 39%

and injury crashes by 76% when they replace a traditional intersection. From a pedestrian and bicycle user perspective, roundabouts are not as easily traversed and refuge areas must be provided to allow people to wait for gaps in the traffic to cross. Finally, because of their traffic flow benefits roundabouts reduce fuel consumption, Carbon Dioxide, and Carbon Monoxide compared to signalized intersections.

Figure 1

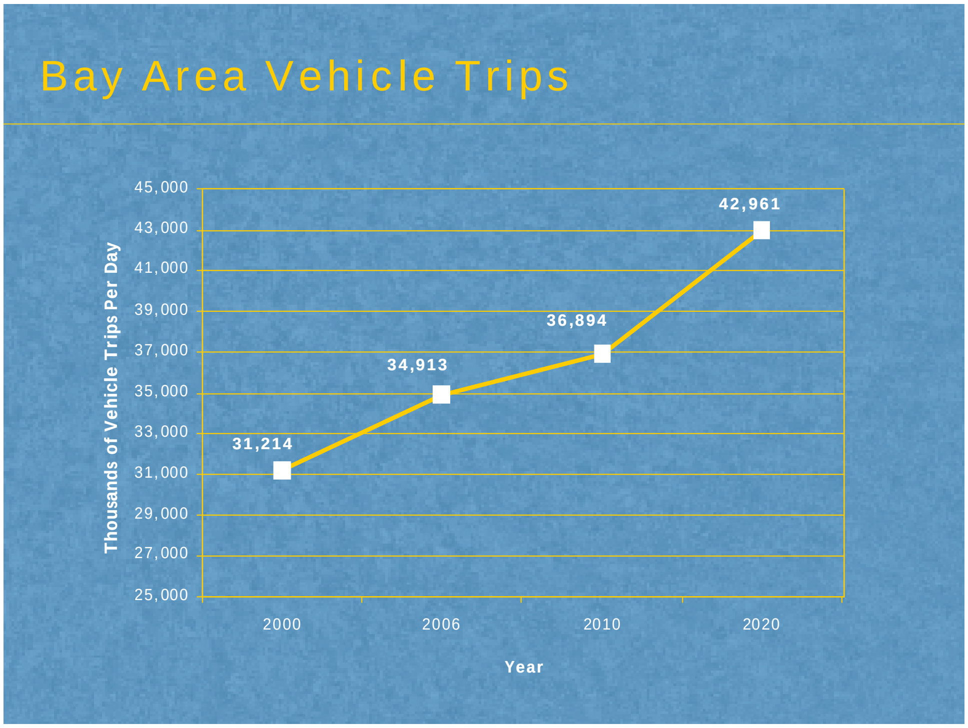



Figure 2

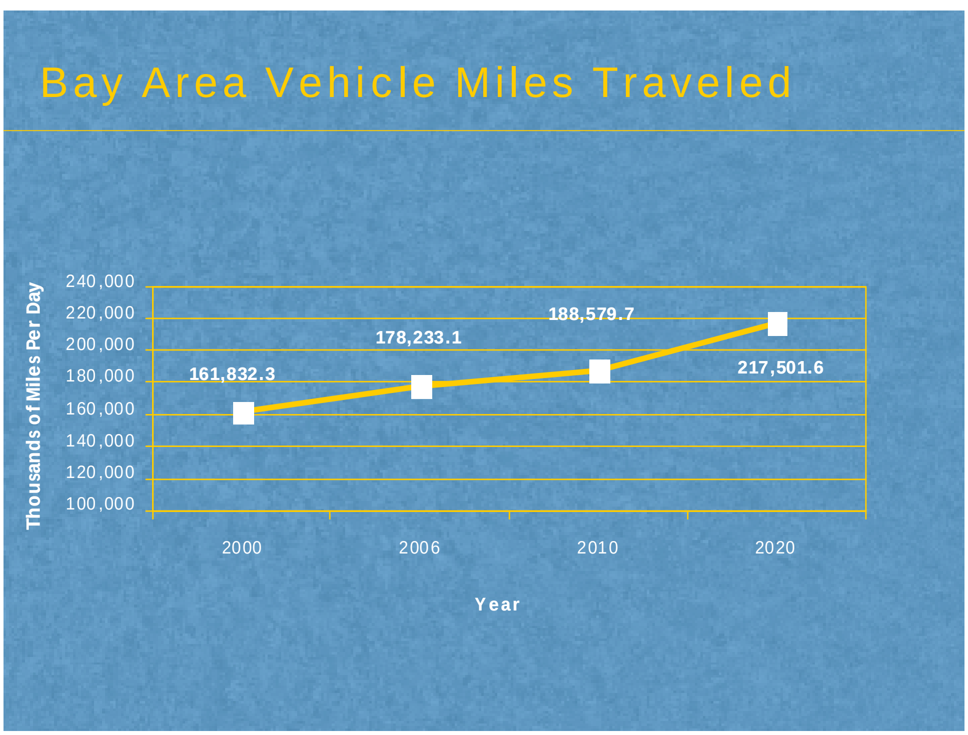


Figure 3

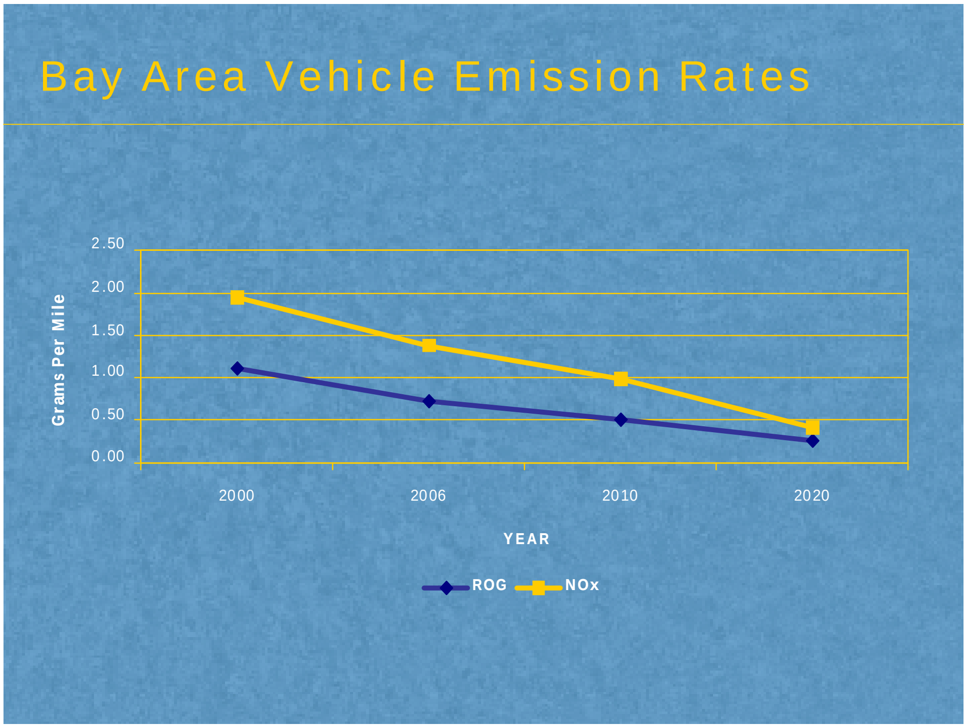



Figure 4

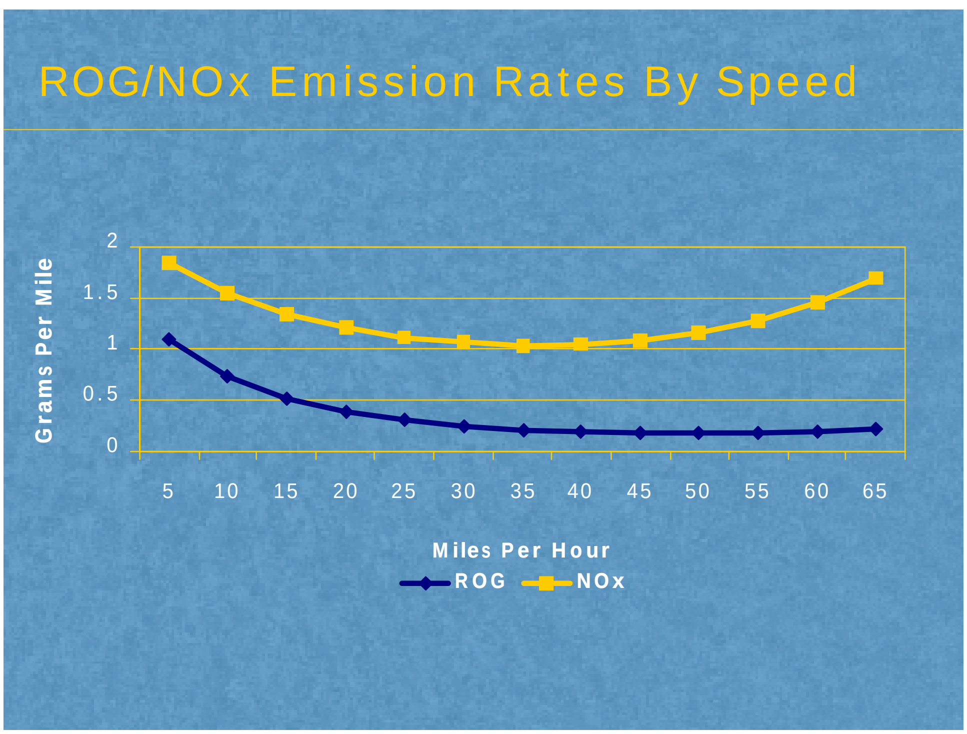


Figure 5

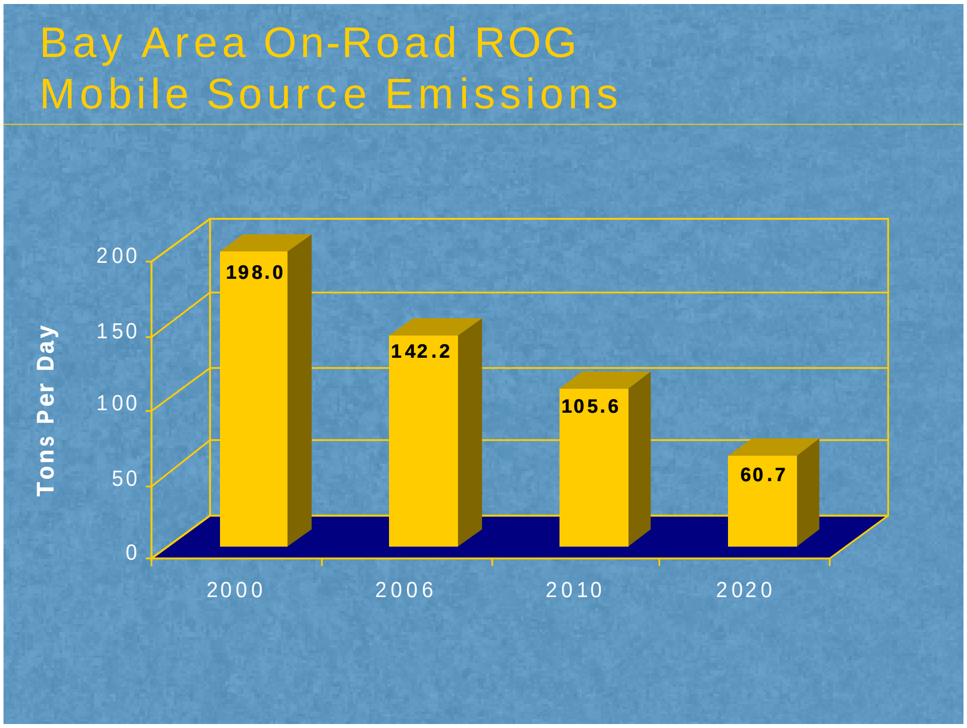



Figure 6

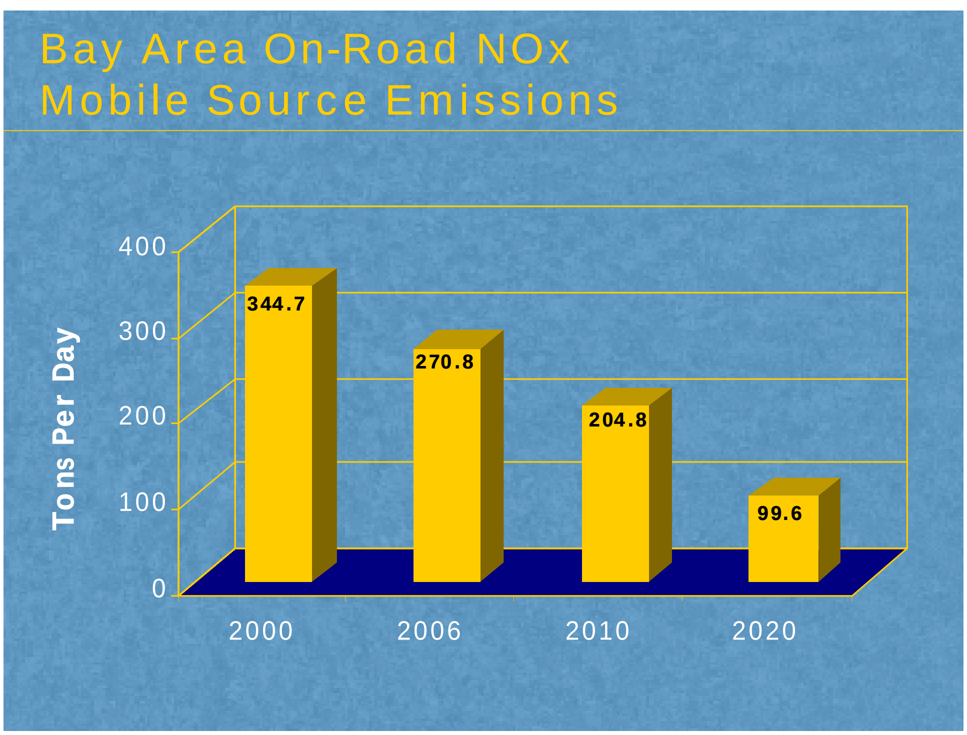


Figure 7

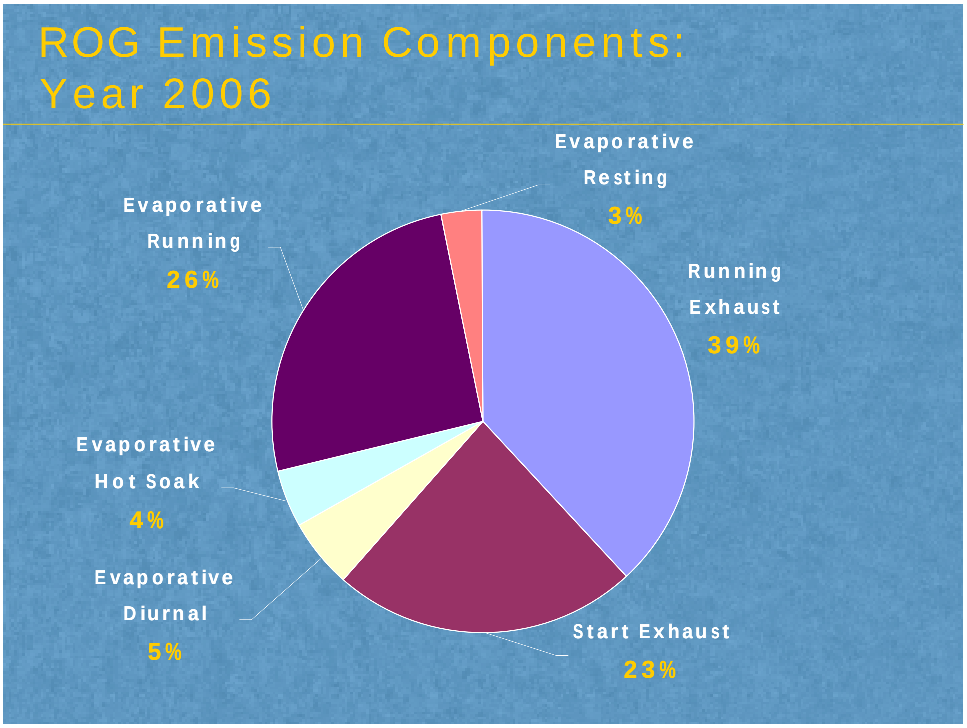
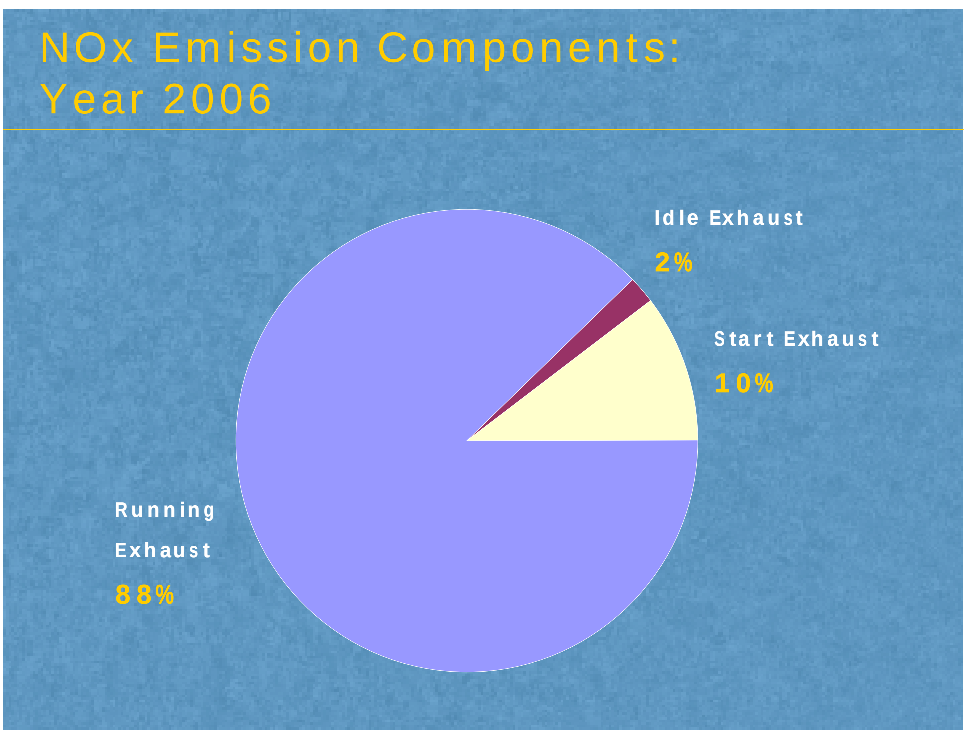



Figure 8



# Appendix

## Responses to Selected TCM Suggestions

### Introduction

A number of suggestions have been received from the public relating to TCM-type measures or air quality planning process issues. A number of these suggestions cannot be readily analyzed in terms of expected emission reduction of ozone precursors, which is the focus of the current ozone planning work. In the spirit of the exercise, we have provided responses to this more diverse set of public comment, categorized under several main topics:

- Planning Process
- Funding
- Smart Growth land use
- New Authority
- Conditioning of funds
- Other

### Planning Process

- Major Investment Studies should include a land use alternative that provides for densification around transit stops, similar to the LUTRAQ alternative studied in Portland, Oregon.
- Suggest MTC convene a peer group review panel to assess how well the MTC travel forecasting models capture latent demand and are sensitive to bike and pedestrian travel with Smart Growth type land uses.
- Develop level of service indicators for all modes, including aspects of Safety, Times for Total Trips, Convenience and Pleasure trips, integration with other modes, and impact on the environment.
- Improve the quality of government decision-making. Provide research and support for analysis of major investments suggested by the public.

### Responses

After several years of regional collaboration, a Smart Growth land use alternative was adopted by ABAG and will be used as the basis for updating MTC's long range regional transportation plan and for individual transportation corridor studies. Also, MTC's corridor study guidelines (prepared by MTC and the Bay Area Partnership in response to the original ISTEA major investment study requirements) continue to encourage study managers to look at complimentary land use changes for any new transportation investment.

MTC has already developed a list of potential refinements to the regional travel demand model which will be implemented in connection with the *Transportation 2030 Plan*. These refinements will help to better capture the effects of Smart Growth land use changes on future travel behavior. Later on when MTC begins the next major update of the regional travel demand model (most likely in the Summer/Fall of 2004), MTC will work with representatives of FHWA and FTA in a peer review of the current model. Among other items, this peer review will address both Smart Growth modeling issues as well as the latest thinking in the modeling community on induced demand.

Regarding level of service measures, a number of efforts are underway to rethink the way transportation system service levels are defined and used to inform decisions about future transportation investments (for example the effort of the San Francisco Transportation Authority). A Smart Growth workshop was recently conducted exclusively on this topic.

Finally, the ongoing Transportation 2030 planning process has engaged in extensive public outreach, including solicitation of ideas from the public on new transportation projects and programs, which they would like to see MTC evaluate. Under SB 1492, MTC is now required to evaluate the performance of transportation projects for possible inclusion in the financially constrained portion of the long range plan. MTC will be evaluating projects submitted by the public that pass certain screening criteria. This is the first RTP process to do so.

**Funding**

- MTC should allocate CMAQ funds separately, based on cost effectiveness, from other fund sources because they are supposed to be used to improve air quality.
- Focus CMAQ funding on light and heavy duty vehicle incentive programs.
- Amend ACA 4 to permit funds allocated to the State or County to be flexed into transit projects.
- Set transit ridership targets and use funding to achieve these.

**Responses**

CMAQ funds are already being used in large part to advance the region's strategies to improve air quality, including Spare the Air, MTC's regional express bus program, retrofitting of urban buses to reduce pollution, TLC/HIP, local bike/ped projects, and TransLink®, as examples. The allocation of funds solely on the basis of their cost effectiveness would exclude other important policy considerations from the allocation process. As the acronym implies, CMAQ funds are intended for both congestion mitigation and air quality activities.

In terms of heavy duty vehicle programs, MTC has recently allocated CMAQ funds to retrofit 1,700 urban buses with devices to control particulates and NOx. To the extent that VOC reductions continue to be the most effective control strategy to reduce ozone, the funding priorities will focus on this task (heavy duty vehicles are generally producers of NOx because they use diesel engines). Significant VOC reductions continue to be achieved through the state standards for automobile engines which result in continuing annual declines as older cars are replaced with newer, cleaner vehicles.

We believe that ACA 4, which shifted the sales tax component of the state gasoline tax from the General Fund to the state transportation fund, already provides significant flexibility for transit. This transfer was approved by voters in 2002 and is distributed: 1) 20% to the Public Transportation Account for transit, 2) 40% to local governments to maintain local streets and roads (which are used by buses), and 3) 40% to the state highway account (STIP) which includes rail transit contruction as an eligible use of funds.

With regard to setting transit targets, the best response is the amount of funding currently dedicated to the support of public transit in MTC's long range plan (over 70%), which exceeds that of all other regional plans around the country. MTC is charged with developing a transportation plan and investment strategy that balances funding among a range of travel needs throughout the region. Dedicating even more funding to transit, which currently serves 6% of daily regional trips, would create funding shortages in other important regional and local programs. Also, as has been noted in the past, the chief constraint to expansion of transit is the lack of new operating funds which are largely locally generated. Finally, transit ridership bears a much closer relationship to factors beyond MTC's control (e.g. status of the economy, gasoline prices, land use densities) than to the amount of public funding dedicated to subsidizing transit service.

**Smart Growth**

- Commit a specific percentage of funds to Smart Growth incentives, including TLC and HIP.
- Prepare a parking manual that provides alternative parking standards for new development near transit or development that incorporates carsharing or various commute alternatives programs that would reduce auto use (e.g. an Ecopass program)
- Retroactively relieve commercial development from parking requirements based on experience with Commute Alternative programs.

**Responses**

MTC's primary incentive program for linking transportation and land use has and continues to be the TLC/HIP program. The current update of the regional transportation plan -- Transportation 2030 – includes funding of TLC/HIP at the tripled levels from the last plan. Within this amount, MTC will be exploring the creation of an incentive program to spur development of local specific plans for Transit Oriented Development around transit stations.

MTC is currently initiating an application to seek state funding from Caltrans to prepare an Alternatives Parking Manual addressing the concepts described above. If successful in obtaining this grant, MTC believes the work would be valuable for not only the Bay Area, but other local jurisdictions around the state who are engaged in Smart Growth discussions.

The third suggestion would, if implemented at the local level, allow major businesses to use land currently dedicated to parking for future expansion of their operations. This would be allowed where there is evidence that commute alternatives programs can provide sustained reduction in parking demand. Thus, the concept can best be pursued at the local level on a case by case basis, using direct experience with specific commute alternatives programs.

New Authority

- Adopt a Regional Transportation Impact Mitigation Fee
- Local jurisdictions should implement a parking tax on employers, based on the number of spaces they own.
- Implement congestion pricing on the Bay bridges and use the surplus revenues to fund transit passes for low income travelers.
- Adopt local ordinances that would unbundle leasing costs for parking

**Responses**
The concept of a regional transportation impact fee is similar to traffic mitigation fees at the local level. As proposed, the concept would lead to higher fees on suburban development due to the traffic burden on the regional transportation system and make urban infill development more competitive in the marketplace. Without further evaluation, the concept raises several conceptual issues: 1) the one time fee would not effect travel behavior of individuals on a daily basis, 2) the fee would add to the already high cost of housing, 3) the fee may duplicate similar existing sub-regional fees, and 4) the long term air quality benefits from land use changes (presuming the fee contributes to such changes) are not nearly as significant as overall trends in vehicle technology.

Parking fees, while a proven factor in shifting travel behavior, remain an elusive control strategy. Employers benefit by offering free parking (recruitment and retention of employees) and have few incentives to charge their employees. Local jurisdictions do not want to antagonize employers that are beneficial in many ways to their community, retailers see parking as a way to attract customers, and neighborhoods fear parking spillover due to lack of space, or in this case, people looking to avoid paying parking charges. Thus while the theory is sound the practical and political barriers are substantial.

There have been a number of expressions of interest in at least testing the concept of congestion pricing on the bridges, the ABAG/MTC/Air District Regional Agency Coordinating Committee and Bay Area Council, different advocacy groups, etc. For these reasons, MTC will continue to examine future opportunities for developing a pilot program, perhaps limited initially to the Bay Bridge. Any such program would address the potential for adverse impacts on lower income Transbay travelers and evaluate remedies. Ultimately approval is required from the State Legislature.

Conditioning MTC Funds to Local Jurisdictions

- Require cities and counties to plan for and implement Smart Growth (various strategies)
- Require cities and counties to have employers implement economic incentives for commute alternatives programs to reduce trips
- Require cities and counties to impose conditions on new development to reduce trips for employers as part of new development approvals.

Response
In the context of this planning exercise, it is assumed that there would need to be a strong nexus between conditioning of funds and achieving measurable reductions in pollutants related to ozone. Unfortunately, the air quality benefits of any of the outcomes based on MTC's conditioning of funding it controls would depend on a long list of assumptions that cannot be known with any certainty. In general, the preferred approach to any of the more difficult public policy issues has been the approach of offering incentives rather than regulation. Nevertheless, the topic of using MTC funding authority for non transportation related outcomes was discussed at great length in 2002/2003 as part of a California Air Resources Board (ARB) initiated stakeholder process. While not fully resolved, all parties agreed that there are certain unknowns in terms of how far MTC can realistically stretch the legislative intent of its enabling legislation beyond approvals and conditions related to

specific transportation projects and programs to quasi-regulatory initiatives in other areas. Several considerations that were discussed in previous meetings were: 1) whether the conditioning of funds would indirectly establish trip reduction requirements on employers (which is inconsistent with state law), 2)whether the conditioning is intended to usurp authority of local jurisdictions to make land use decisions (local control has been a "given" in discussions of new regional approaches to Smart Growth implementation); and 3) the extent to which MTC withholding of certain funds—primarily STP and CMAQ—to local jurisdictions would have any effect on their decisions (for example in the current TIP, only about $74 million out of $9.5 billion, or less than1%, goes to local governments, and these funds are mostly used for road maintenance, bike/ped projects, and TLC/HIP, all of which are key to implementing MTC's goals in the long range transportation plan).

In adopting its "Transportation and Land Use Policy Platform" for the Transportation 2030 Plan in December 2003, the Commission has determined that a sufficient nexus does exist between regional investment of rail and bus expansion funds and local zoning decisions in station areas where those funds will be invested.  In particular, the platform proposes to condition the award of regional discretionary funds under MTC Resolution No. 3434 to a demonstration that local plans have been adjusted to provide some level of increased housing/mixed use density in the station areas.

**Other**
1) Develop rail and transit hubs with generous bike facilities instead of massive auto parking space.
2) Establish 2-person instead of 3-person carpool requirement for the new Benicia Bridge.
3) Fund free bus passes for students.
4) Replace noisy, polluting buses with more frequent service by smaller and cleaner buses and vans.
5) Have public agencies implement parking charges at agency owned public parking lots.
6) Remove signals on the Richmond Parkway in order to reduce pollution from trucks as they accelerate from stop at a local intersection onto the Parkway.

<u>Responses:</u>
1) MTC studied opportunities for expanding bike storage at a number of transit centers in the evaluation of Further Study Measure 5 in the 2001 Ozone Plan. MTC's ongoing Transit Connectivity Study will also address identify a group of regional transit hubs for the purpose of expanded investment for a variety of amenities.
2) It is unlikely that the air quality effects of changing occupancy requirements on a single bridge would be significant in a regional context, nor would changes in traffic conditions at the toll plaza likely affect readings at the Concord monitor. However, from MTC's perspective, the adverse impacts of changing the number of paying vehicles could have significant adverse impacts on funding commitments to construct the Benicia Bridge. These have been outlined by MTC in previous correspondence.
3) MTC and AC Transit established a pilot program to evaluate the use of student passes for improved attendance and participation in after school activities. A total of 25,000 free bus passes were distributed to low-income students attending middle or high schools located within AC Transit's service area, which covers all of Alameda County and western Contra

Costa County. This represented about two-thirds of the students eligible to receive the pass; those enrolled in the Free or Reduced Lunch (FRL) Program. Six school districts out of a total of seven participated in program, with most free passes being distributed in the Richmond and Oakland School Districts. In order to learn about students' travel patterns, researchers evaluating of the program administered a survey the year prior to initiation of the free bus pass program (2002), and again during the spring of 2003, once the program had been in place for most of the school year. The results of survey did not reveal any significant trends that would suggest the potential for significant emission reductions in the future.

4) A number of efforts are underway to reduce pollution from urban buses, including the program funded by MTC to retrofit 1,700 buses with devices to lower particulate matter and Nitrogen Oxides. The air quality implications of running a greater number of smaller buses have not been analyzed, but the current shortage of transit operating funds would make such a strategy infeasible.

5) The evaluation conducted under Further Study Measure 4 (2001 Ozone Attainment Plan) showed that over 80% of existing municipally provided parking space is already charged. Thus the additional air quality benefit of charging the remaining space would not likely be significant from a mode shift perspective, and there may be other local reasons for not charging this space.

6) As a general comment, the Richmond Parkway was developed as a way to remove truck traffic from neighborhood streets, and was initially called the "North Richmond Bypass". The Parkway was constructed largely with local transportation sales tax funds, and was built as an at grade facility with signalized intersections. There are 18 intersections on the Parkway itself and 3 on South Garrard. Truck movement in West County has been studied extensively and most recently in a report titled *Truck Route/Weight Limitations Survey for West Contra Costa County* (Dowling and Associates, December 2001). About 25% of all truck movements in West Contra Costa County occur on the Parkway. Grade separating the signalized intersections, so that some trucks would not need to stop at intersections would be very costly. At a likely cost of over $10 million per intersection, there would not be sufficient local or regional funds to accomplish a comprehensive grade separation project. A more workable approach at much lower cost might be to identify trucks that routinely use the Parkway and retrofit these trucks with emission control devices that lower particulate emissions (and perhaps Nitrogen Oxides, which contribute to ozone).